

X-RAY PELVIMETRY IN PRIMIPARAS. I: ROLE OF PHYSIOLOGICAL MATURITY

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X-ray pelvimetry offers an accepted, objective, and reproducible method for evaluation of pelvic capacity. One hundred-thirty primiparous parturients, 16 years of age and younger, who had had x-ray pelvimetries when admitted for delivery at term were studied. These findings were contrasted with the findings on 150 primiparous parturients who were 20 years of age and older at term.

The mean age for the adolescents was 15.4 years and for the older group, 24.1. The most common indication for pelvimetry was suspected disproportion (A = 60.8 percent, O = 65.3 percent). Contrary to expectations, many similarities were noted in the women of both groups. Four of the six diameters compared were similar when adolescents were contrasted with older women. Both diameters of the inlet were smaller among the adolescents as contrasted with the older women, who had a higher proportion of larger than average diameters. The clinical implications of these findings are presented.

About 20 percent of deliveries in this country occur to women 18 years or younger.¹ The adolescent fertility rate, especially among young adolescents, continues to increase. Also the number of adolescents has increased.² Thus, adolescent pregnancies are commonly managed in most obstetrical services in this country.

Although heredity, nutrition, and disease influ-

ence body development, many have wondered if early pregnancies prevent women from reaching their potential maturity. If abdominal deliveries for cephalopelvic disproportion (CPD) are considered a measure of pelvic capacity, the available literature offers conflicting evidence. Some reports indicate an increased number of abdominal deliveries for adolescents.^{3,4} Others do not find any differences in the incidence of abdominal deliveries due to CPD among adolescents; some even present a lower incidence in adolescents than in older women.⁵⁻⁷

Granted, pelvic architecture is only one of several factors which determine length of labor and the route of delivery, but it is a factor that can be conveniently and objectively reviewed any time. X-ray pelvimetry offers a permanent and objective method for the evaluation of pelvic size.

The purpose of this study is to determine, by studying x-ray pelvimetries, whether the age of the parturient has any effect on the size of the pelvis.

MATERIAL AND METHODS

Parturients admitted at term to Mount Sinai Hospital Medical Center of Chicago were included in this study if they had had x-ray pelvimetries on admission for deliveries. In order to avoid the influence of previous pregnancies, only primigravidas were included (women with previous abortions were excluded). In order to emphasize the age differences, only women 16 years of age and younger (adolescents) and 20 years and older (older) were included in this study.

One hundred-thirty women comprised the adolescent group, with 150 constituting the older group. Both groups represent 20.4 percent of the total of primigravidas of similar age group deliv-

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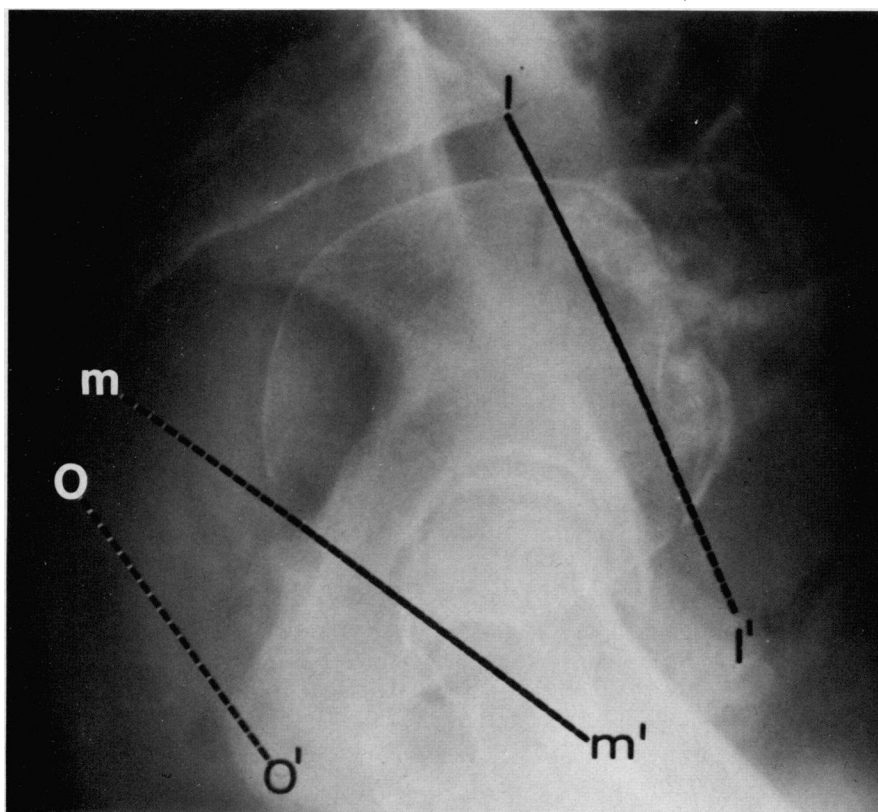


Figure 1. Lateral view of the pelvis—anteroposterior diameters: II' (inlet); MM' (midplane); OO' (outlet)

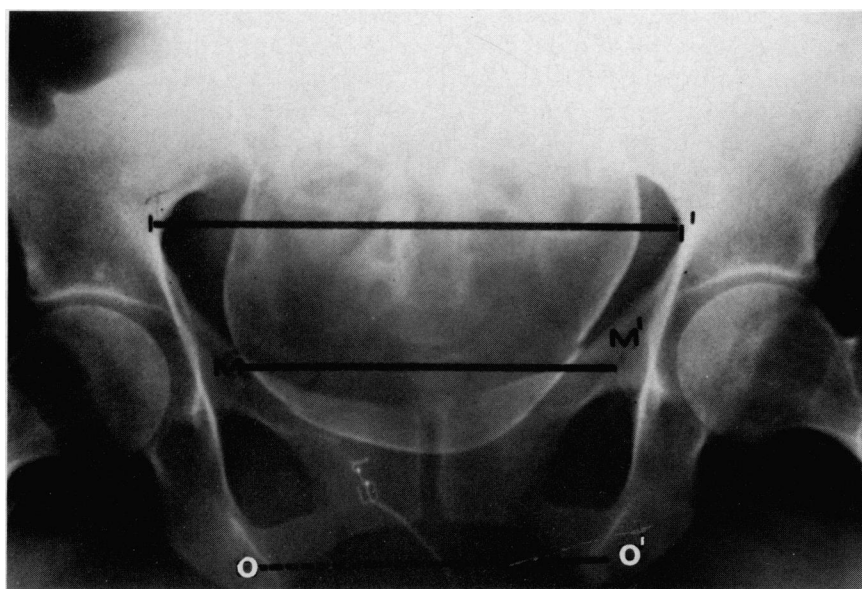


Figure 2. Anteroposterior view of the pelvis—transverse diameters: II' (inlet); MM' (midplane); OO' (outlet)

TABLE 1. X-RAY PELVIMETRY IN PRIMIPARAS (%)

Reasons for Pelvimetry	Adolescent (n=130)	Older (n=150)
Induction Suspected breech	36.2	32.0
Suspected cephalopelvic disproportion	3.1	2.7
	60.7	65.3

ered at this institution from 1972 to 1979 for the adolescent group (A) and from 1972 to 1977 for the older group (O).

The clinical records of these women were reviewed to study their demographic characteristics, significant antecedents, complications of pregnancy, labor and delivery, and the characteristics of their newborns.

The Colcher-Sussman technique⁸ was the radiological technique employed. After adequate positioning of the patient, anteroposterior and lateral views of the pelvis were obtained. (Graduate rulers are included in the same films.) These films were reviewed and read to the closest millimeter. Six diameters were recorded: anteroposterior (AP) and transverse (T) diameters of the pelvic inlet, midplane, and outlet (Figures 1 and 2).

The average diameter measurements of adolescents and older women were compared. The proportion of smaller than average and larger than average diameters were also compared. The statistical significance of the differences was established by χ^2 test and the standard error (SE) (when the differences were twice the SE, $P = 0.05$).

The most common type of delivery was spontaneous vertex (A = 53.9 percent, O = 42.6 percent), followed by cesarean delivery (A = 28.5 percent, O = 34.7 percent). The most common reason for cesarean was CPD (A = 78.4 percent, O = 76.9 percent), followed by fetal distress (A = 13.5 percent, O = 15.4 percent). The reasons for pelvimetry are illustrated in Table 1, and the newborn weights are depicted in Table 2. The differences between the groups were not significant.

Adolescents and older parturients were also clinically similar in relation to length of gestation, pregnancy complications, type of deliveries, length of labor, presentation and position, characteristics of the newborn, complications of vaginal

TABLE 2. NEWBORN WEIGHT (%)

Weight (gm)	Adolescent (n=131)*	Older (n=154)**
≤2500	8.4	7.1
2501-4500	90.8	92.3
>4500	0.8	0.6
Average	3241.3	3241.3

*One set of twins.

**Four sets of twins.

TABLE 3. DEMOGRAPHIC CHARACTERISTICS

	Adolescent (n=130)	Older (n=150)
Age (years)		
Average	15.4	24.1
Range	13-16	20-37
Ethnicity (%)		
Black	94.6 *	68.7
Hispanic	4.6	16.0 *
White	—	11.3
Other	0.8	4.0
Payment Method (%)		
Public Assistance	93.1 *	48.0
Insurance	4.6	28.7 *
Cash	2.3	23.3 *

* $P < 0.001$

deliveries, and postdelivery length of stay. Table 3 shows that, besides age, the groups were statistically different in relation to the proportion of blacks among the adolescents and the ability of the older patients to pay cash.

RESULTS

The average midplane AP was 12.4 cm for the adolescents and 12.5 cm for the older. The average midplane T diameter was 10.0 cm for the adolescents and 10.1 cm for the older. The average outlet AP diameter was 8.5 cm for the adolescents and 8.4 cm for the older. The outlet T diameter was 9.8 cm for the adolescents and 9.9 cm for the older women. The average diameters of the midplane and outlet was consistently smaller among the adolescents when compared with the older women, but these differences were not statistically significant.

However, the average inlet AP diameter for the

TABLE 4. MIDPLANE DIAMETERS

	Adolescent		Older	
	No.	(%)	No.	(%)
Anteroposterior (cm)				
≤11.0	14	(10.8)	18	(12.1)
11.1-12.0	36	(27.7)	28	(18.5)
>12.0	80	(61.5)	104	(69.4)
Total	130	(100)	150	(100)
Transverse diameter (cm)				
≤10.0	73	(56.2)	69	(46.0)
10.1-11.0	42	(32.3)	56	(37.4)
>11.0	15	(11.5)	25	(16.6)
Total	130	(100)	150	(100)

TABLE 5. OUTLET DIAMETERS

	Adolescent		Older	
	No.	(%)	No.	(%)
Anteroposterior (cm)				
≤8.0	44	(33.8)	66	(43.9)
8.1-9.0	46	(35.5)	35	(23.4)
>9.0	40	(30.7)	49	(32.7)
Total	130	(100)	150	(100)
Transverse (cm)				
≤8.0	8	(6.1)	6	(4.1)
8.1-9.0	21	(16.2)	28	(18.7)
>9.0	101	(77.7)	116	(77.2)
Total	130	(100)	150	(100)

adolescents was 11.9 cm in contrast with 12.3 cm for the older women. Also, the average inlet T diameter for the adolescents was 11.5 cm in contrast with 12.5 cm for the older women. The differences between the adolescents' and older women's diameters were statistically significant ($P=0.01$).

Tables 4 and 5 illustrate the proportion of smaller than average and larger than average diameters of the midplane and the outlet. No significant statistical differences are noted.

Table 6 shows the proportion of smaller than average and larger than average diameters of the inlet. The incidence of larger than average diameters is significantly higher among the older women. In relation to the T diameter, the incidence

of smaller than average diameters is significantly higher among the adolescents when compared to the older women who have a higher incidence of larger than average diameters.

The higher incidence of smaller diameters among the adolescents may be attributed to the greater proportion of black women in the adolescent group (Table 3). In order to avoid this bias, only black women of both groups were compared (Table 7). A similar tendency was noted in both groups' diameters, especially the transverse diameters. Table 8 illustrates that even when only blacks are compared, the proportion of adolescents on public assistance is still significantly higher. Despite that, affiliation with public assistant programs is not necessarily associated with

TABLE 6. INLET DIAMETERS

	Adolescent		Older	
	No.	(%)	No.	(%)
Anteroposterior (cm)				
≤11.0	24	(18.5)	16	(10.7)
11.1-12.0	54	(41.6) *	45	(30.0)
>12.0	52	(39.9)	89	(59.3)†
Total	130	(100)	150	(100)
Transverse (cm)				
≤12.0	84	(64.6)††	45	(30.0)
12.1-13.0	41	(31.6)	58	(38.7)
>13.0	5	(3.8)	47	(31.3) * *
Total	130	(100)	150	(100)

*P=0.05

**P=0.01

†P<0.01

††P<0.0001

TABLE 7. INLET DIAMETERS: BLACK PRIMIPARAS ONLY

	Adolescent		Older	
	No.	(%)	No.	(%)
Anteroposterior (cm)				
≤11.0	22	(17.9)	11	(10.6)
11.1-12.0	54	(43.9)	33	(32.1)
>12.0	47	(38.2)	59	(57.3) *
Total	123	(100)	103	(100)
Transverse (cm)				
≤12.0	81	(65.9) **	40	(38.8)
12.1-13.0	38	(30.9)	39	(37.9)
>13.0	4	(3.2)	24	(23.3) **
Total	123	(100)	103	(100)

*P<0.05

**P<0.001

a less balanced diet; this is usually a common assumption. Our records do not show the length of our patients' affiliation with such a program, but higher economic levels are not necessarily associated with better nutrition.

Table 9 illustrates a comparison of only those black women who were on public assistance when hospitalized for delivery. Once again, a significantly higher incidence of smaller than average diameters are noted among the adolescents as contrasted with the higher incidence of larger than average diameters among the older women.

TABLE 8. METHOD OF PAYMENT
OF BLACK PRIMIPARAS

	Adolescent No. (%)		Older No. (%)	
Public Assistance	115	(93.5) *	65	(63.1)
Insurance	5	(4.1)	20	(19.4)
Cash	3	(2.4)	18	(17.5)
Total	123	(100)	103	(100)

*P<0.001

TABLE 9. INLET DIAMETERS OF BLACK PRIMIPARAS ON PUBLIC ASSISTANCE

	Adolescent No. (%)		Older No. (%)	
<hr/>				
Anteroposterior (cm)				
≤11.0	19	(16.5)	8	(12.3)
11.1-12.0	51	(44.3) *	19	(29.3)
>12.0	45	(39.1)	38	(58.4) **
Total	115	(100)	65	(100)
Transverse (cm)				
≤12.0	76	(66.2) **	29	(44.6)
12.1-13.0	35	(30.3)	21	(32.3)
>13.0	4	(3.5)	15	(23.1) †
Total	115	(100)	65	(100)

*P=0.05

**P<0.05

†P<0.01

DISCUSSION

Factors which have a significant role in relation to the length of labor and the type and outcome of delivery are: uterine activity, complications of pregnancy and labor, amount of medication used, maternal hydration and well-being, pelvic architecture, fetal size, presentation, position, attitude, and anomalies. Other important factors are the parturient's attitude about pregnancy and labor, and the attitudes of those in attendance.

All these factors may be affected by maternal age. Though pelvic size is only one of the factors that determines the outcome of a labor, pelvic diameters may be measured more objectively. In this study, there were not significant clinical differences between adolescents and older women. Maternal age was the obvious difference, suggesting that this was the reason for the differences noted in pelvic sizes as measured by radiological techniques.

The fact that adolescents in this study had smaller inlet diameters (especially transverse diameters) than the older women is noteworthy. Before puberty, the anthropometric measurements for most boys and girls are almost similar. (The shape of the inlet is similar in boys and girls.) Growth decreases in velocity from fertilization to just before adolescence when the velocity of growth suddenly increases. Prepubertal girls studied by serial x-ray pelvimetries have shown an elongated inlet (AP diameter longer than T).⁹ Dur-

ing puberty, the most obvious change is the maturation of the sex organs. The pelvis grows predominately in its transverse diameter (more than AP), and there is a rounding of the forepelvis and a disappearance of the acetabular constriction.⁹

Menarche occurs usually after the growth spurt peaks. Ninety percent of girls menstruate before their breasts are fully developed. The mean interval between full breast development and peak increase in height is 1.01 ± 0.77 year.¹⁰ When menarche occurs, girls are in the deceleration phase of growth and have achieved all but about 5 cm of their adult height.

The growth spurt before and even after the puberty may well be adequate to prepare the bony pelvis for parturition within one to two years. In those girls in whom puberty occurred early, radiological changes of the pelvis were completed within a relatively short time (18 months). In those girls whose puberty occurred later, the pelvic changes took longer.⁹ Coleman,¹¹ also studying pelvimetries, observed growth to 18 years of age. Thus pelves may continue to grow to that age.

Hulka and Schaff⁴ found that the incidence of CPD was associated with age: 60 percent at 12 years, 28.5 percent at 13, and 13 percent when the parturient was older than 13. They considered 14 to 15 years the dividing line for CPD. Bataglia et al³ found CPD in 35.7 percent of women younger than 15 as contrasted with a 13 percent incidence in the general population. (More recent studies⁵⁻⁷ do not confirm this increased incidence of CPD

among adolescents.) In this study 90 percent of the adolescents were 15 to 16 years of age; the influence of those 13 (2.3 percent) and 14 (7.7 percent) is obviously minimal. Still most of them have a smaller inlet when contrasted with the older women. This study demonstrates more clinical similarities than differences between both groups, except for maternal age. It appears that the younger women has not yet completed her pelvic growth and remodeling. This finding has also been noted by Aiman.¹²

On the other hand, sex hormones play an important role during puberty; these hormones are also increased during pregnancy. The importance of estrogens in somatic growth and epiphyseal fusion remains unclear. In most cases of increased estrogen secretion or administration, there is a concomitant change in the secretion of adrenal androgens.¹³ Among anabolic agents, estrogens have the least effect upon nitrogen retention, and large doses may even inhibit nitrogen retention.¹³ Androgens determine the female adolescent spurt. Androgens accelerate both epiphyseal ossification and fusion.¹³ As androgen levels increase during pregnancy,¹⁴ they may influence the adolescent's pelvic architecture which might otherwise achieve larger dimensions. A study of multiparous women who had pelvimetries when first pregnant during their adolescence and again in later years may be required to elucidate whether an adolescent pelvis continues to grow following pregnancy.

Whatever the reasons, in this study adolescent pelvis measured by x-ray pelvimetry are smaller than those of older women. This finding should not be construed as a higher risk for abdominal deliveries for adolescents, nor does it establish maternal age as another indication for mandatory x-ray pelvimetry. This and other studies have demonstrated that adolescents are not at higher risk for abdominal deliveries due to CPD.

Besides, the differences between the diameters (less than 1 cm) are minimal. Campbell¹⁵ eloquently has stated that during labor fetal head molding averages more than 1 cm. Furthermore, the mobility of sacroiliac joints and pubic symphysis may determine a 1 to 2 cm increase of the outlet sagittal dimensions when the parturient changes from decubitus to standing (as the midplane T diameter may increase 1.6 cm when the parturient changes from supine to semisquatting position). These changes of the diameters and

also of pelvic capacity render pelvimetry of questionable prognostic value in most cases. This fact, however, does not change the conclusion of this study in which the diameters of both groups were radiologically measured in similar conditions.

In summary, we studied by x-ray pelvimetry the pelvic size of 130 adolescents and 150 older parturients who were similar clinically. Race, economic status, and age were different. The adolescent diameters, especially transverse diameters, were smaller than those of older women. The older women have a higher incidence of larger than average diameters when contrasted with the adolescents. These differences were still significant when ethnic and economic variables were excluded. The pelvic size as determined by x-ray pelvimetry does not affect the route of delivery.

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